

PROPOSED WORKPLAN FOR DEVELOPING A SITE-SPECIFIC SELENIUM WATER-COLUMN CRITERION FOR LAKE KOOCANUSA¹

1.0 Goal

The goal of this workplan is to derive a site-specific water-column selenium criterion (or multiple criteria) for Lake Koocanusa (the reservoir) that protects all fish species in the ecosystem². The *level of protection* will be defined by the regulatory agencies.

2.0 Decisions and Constraints

The following decisions and decision constraints are needed to set the stage for deriving a site-specific selenium water-column criterion for Lake Koocanusa:

- The basis for this criterion should be scientifically sound and transparent.
- The site-specific criterion will meet the regulatory requirements to protect threatened or endangered species under the U.S. Endangered Species Act.³
- The site-specific criterion will meet the regulatory requirements to protect the designated uses of waterbodies under the U.S. Clean Water Act.
- The site-specific criterion also will consider ecologically significant species and those important to stakeholders (see Table 2 in Jenni et al., 2017⁴)
- The site-specific criterion will protect 100% of the fish species in the reservoir assuming a reproductive endpoint from reproductively mature females that are feeding in an ecosystem that functions as a lentic reservoir.
- The site-specific criterion will provide long-term protection for fish in all parts of the reservoir during all phases of reservoir operation, all selenium loading profiles, and all water years (precipitation/runoff scenarios).
- The site-specific criterion will protect the ecosystem during maximum dietary exposure.
- The site-specific criterion also will protect downstream uses including protection of the endangered Kootenai River white sturgeon.

¹ As stated in the accompanying transmittal memo, these are the recommendations of the U.S. federal technical participants. (Disclaimer: this document in its final form as submitted for funding is subject to individual agency review.)

² This assumes that fish are the most sensitive aquatic endpoint and serve as a surrogate for the protection of all aquatic life in the reservoir.

³ For ESA-listed species of fish and wildlife, a site-specific water quality criterion can only be approved by EPA if the criterion either would not harm a single individual of any listed species, or would harm so few individuals as to avoid a "jeopardy" biological opinion under s.7 of the ESA. If even one individual could reasonably be expected to be harmed (as might be the case for a criterion that is based on an EC-10 level of toxicity), at a minimum, a formal biological opinion would have to be prepared by USFWS and an incidental take statement would be required, which could include perpetual monitoring requirements for the documentation of compliance with the incidental take statement.

⁴ Jenni, K.E., Naftz, D.L., and Presser, T.S., 2017, Conceptual modeling framework to support development of site-specific selenium criteria for Lake Koocanusa, Montana, U.S.A., and British Columbia, Canada: U.S. Geological Survey Open-File Report 2017–1130, 14 p., <https://doi.org/10.3133/ofr20171130>.

3.0 Level of Protection

The following alternative protection levels will be run for Lake Koocanusa:

- *Alternative 1:* the model-derived water-column criteria will provide a level of protection expected to ensure that **the maximum value of any individual of any species in the lake** will not exceed the BC egg-ovary criterion of 11.0 mg Se/kg.
- *Alternative 2:* the model-derived water-column criteria will provide a level of protection ensuring that **the population value for any species in the lake** will not exceed the BC egg-ovary criterion of 11.0 mg Se/kg.
- *Alternative 3:* the model-derived water-column criteria will provide a level of protection expected to ensure that **the maximum value of any individual of any species in the lake** will not exceed the USEPA egg-ovary criterion of 15.1 mg Se/kg.
- *Alternative 4:* the model-derived water-column criteria will provide a level of protection expected to ensure that **the population value of any species in the lake** does not exceeds the USEPA egg-ovary criterion of 15.1 mg Se/kg.

4.0 Ecosystem-Scale Selenium Model

An ecosystem-scale selenium model will be developed for Lake Koocanusa as outlined in Presser and Luoma, 2010⁵ and Jenni et al., 2017^[NOTEREF _Ref2312691 \h \v MERGEFORMAT]. The U.S. Geological Survey will set up, run, and document the model. This process will include the following steps:

- Data Compilation: Compile selenium data and any other data relevant to the model as an update to the existing USGS Science Base product for Lake Koocanusa⁶
- Conduct the following analytical steps and include these items in a peer-reviewed report (USGS Scientific Investigations Report: *Understanding and Documenting the Scientific Basis of Selenium Ecological Protection in Support of Criteria Development for Lake Koocanusa*)
 - Document historical exceedances of national or provincial environmental selenium guidelines (i.e., status of ecosystem)
 - Identify and document managed reservoir dynamics
 - Identify and document managed habitat-use
 - Identify and document food webs, dietary biodynamics, partitioning, and bioavailability within an ecosystem-scale selenium modeling methodology
 - Identify and document tissue conversion factors
 - Develop and document model input parameters, including appropriate representation of uncertainty the implication of those uncertainties for interpretation of model outputs
 - Determine if multiple sub-models are needed for different parts of the reservoir
 - Identify and document model inputs, including rationales for all decisions (e.g., averaging periods etc.)
 - Run ecosystem-scale selenium model to predict bioaccumulation based on dietary biodynamics within site-specific food webs (i.e., particulate material through invertebrates to fish)
 - Validate model outcomes by comparison to observed conditions

⁵ Presser, T.S., and Luoma, S.N., 2010a, A methodology for ecosystem-scale modeling of selenium: Integrated Environmental Assessment and Management, v. 6, no. 4, p. 685–710.

⁶ Presser, T.S., Naftz, D.L., and Jenni, K.E., 2018, USGS Measurements of Dissolved and Suspended Particulate Material Selenium in Lake Koocanusa in the Vicinity of Libby Dam (MT), 2015-2017 (update): U.S. Geological Survey data release, <https://doi.org/10.5066/P9HB5S5F>.

- Determine the most sensitive species, food web, site, and water or contaminant-cycle condition
- Identify, run, and document model translation scenarios (What are the concentrations in the reservoir's water-column that generate the tissue criterion for each scenario?)
- Identify and document model uncertainty

5.0 Supplemental Material: Bioaccumulation Factors (BAFs)

While the mechanistic eco-system scale selenium model was chosen as the primary model, as recommended in EPA's 2016 national selenium criterion document⁷, it is noted that there is more water and fish tissue data for Lake Koochanusa (at more locations and times) than there is data on the full food web. As an informational and supportive calculation, water column criterion corresponding to each of the alternative levels of protections described above will also be calculated the bioaccumulation factor (BAF), an empirical approach for deriving site-specific water column criteria for selenium, as described in EPA, 2016, Appendix K, Section 2.

Since the BAF approach will support the mechanistic model, the level of protection alternatives, metrics assumptions, and underlying policy decisions will be the same, where applicable. Species selection for the BAF approach will be limited, focusing on high bioaccumulator species and species of special interest where the BAF approach can be used in a diagnostic way to further inform the outcomes of the mechanistic model. As an informational and supportive calculation, water column concentrations corresponding to each of the alternative levels of protections described above will also be calculated using an empirical Bioaccumulation Factor (BAF) approach as described in EPA, 2016, Appendix K, Section 2. A report documenting procedures and results of the BAF approach will be prepared and will explain the basis for and applicability of the specific data used to estimate a BAF for each species considered.

⁷ USEPA, 2016, Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater 2016. EPA 822-R-16-006. https://www.epa.gov/sites/production/files/2016-07/documents/aquatic_life_awqc_for_selenium_-_freshwater_2016.pdf